

We Claim:

- 1 1. A method for synthesizing carbon nanostructures comprising:
2 providing a substrate having a deposition mask;
3 depositing a metalorganic layer on the substrate, wherein at least a portion of the
4 metalorganic layer is deposited on an unmasked portion of the substrate ;
5 removing the deposition mask from the substrate;
6 oxidizing said portion of the metalorganic layer deposited on an unmasked portion of the
7 substrate to form a growth catalyst on the substrate; and
8 exposing the substrate to a carbon precursor gas at a deposition temperature to form
9 carbon nanostructures.
- 1 2. The method of claim 1, wherein the metalorganic layer is composed of iron
2 phthalocyanine.
- 1 3. The method of claim 1, wherein the metalorganic layer is deposited by a physical vapor
2 deposition process.
- 1 4. The method of claim 1, wherein the deposited metalorganic layer has a thickness of
2 between about 1 micron and about 30 microns.
- 1 5. The method of claim 1, wherein the deposition mask is composed of a metal oxide.
- 1 6. The method of claim 1, wherein the deposition mask is composed of a substance selected
2 from the group consisting of silicon oxide and aluminum oxide.

- 1 7. The method of claim 1, wherein the unmasked portion of the substrate has a top surface
2 composed of a metal oxide.
- 1 8. The method of claim 7, wherein the metal oxide is selected from the group consisting of
2 silicon oxide, aluminum oxide, and magnesium oxide.
- 1 9. The method of claim 1, wherein oxidizing said portion of the metalorganic layer
2 deposited on an unmasked portion of the substrate comprises exposing said portion of the
3 metalorganic layer to an oxygenated atmosphere at a temperature of between about 450°C and
4 about 500°C.
- 1 10. The method of claim 9, wherein said portion of the metalorganic layer is exposed to the
2 oxygenated atmosphere for between about 2 hours to about 4 hours.
- 1 11. The method of claim 1, wherein the growth catalyst comprises metal growth catalyst
2 particles.
- 1 12. The method of claim 1, wherein the carbon precursor gas is methane.
- 1 13. The method of claim 1, wherein exposing the substrate to a carbon precursor gas
2 comprises exposing the substrate to an atmosphere containing methane, argon, and hydrogen.
- 1 14. The method of claim 13, wherein the substrate is exposed to the carbon precursor gas for
2 between about 15 minutes and about 60 minutes.
- 1 15. The method of claim 1, wherein the deposition temperature is about 700°C.
- 1 16. The method of claim 1, wherein the metalorganic substance is purified prior to deposition
2 of the metalorganic layer.

- 1 17. The method of claim 1, wherein the oxidizing said portion of the metalorganic layer is
2 performed prior to removing the deposition mask from the substrate.
- 1 18. The method of claim 1, wherein said carbon nanostructures are single wall carbon
2 nanotubes.
- 1 19. The method of claim 1, wherein said carbon nanostructures are one dimensional carbon
2 nanostructures.
- 1 20. A system for producing carbon nanotubes, the system comprising:
2 a reactor capable of supporting a plurality of temperature zones and having an air-tight
3 chamber where a source of carbon precursor gas and a source of inert gases is provided;
4 a sample holder placed within a first temperature zone;
5 a masked substrate place within a second temperature zone; and
6 an evacuating system connected to the reactor for evacuating gases from the chamber.
- 1 21. The system of claim 20, wherein the first temperature zone is about 150 °C to about 350
2 °C hotter than the second temperature zone.
- 1 22. The system of claim 21, wherein the first temperature zone is about 200 °C to about 300
2 °C hotter than the second temperature zone.
- 1 23. The system of claim 20, wherein the carbon precursor gas is selected from the group
2 consisting of methane, ethane, propane, ethylene, propene, and carbon dioxide.
- 1 24. The system of claim 20, wherein the inert gas is selected from the group consisting of
2 hydrogen, helium, argon, neon, krypton and xenon or a mixture thereof.
- 1 25. The system of claim 20, wherein the sample holder provides the catalyst.

- 1 26. The system of claim 25, wherein the catalyst is an metalorganic wherein the metal is
2 selected from the group consisting of iron and molybdenum or mixtures thereof.
- 1 27. The system of claim 26, wherein the catalyst is selected from the group consisting of iron
2 phthalocyanine and molybdenum phthalocyanine or mixtures thereof.
- 1 28. A carbon nanotube structure produced by the process of :
2 depositing a metalorganic layer on a substrate having a deposition mask;
3 oxidizing the metalorganic layer deposited on an unmasked portion of the substrate; and
4 exposing the substrate to a carbon precursor gas at a deposition temperature to form
5 carbon nanotube structure.
- 1 29. The process of claim 28, wherein depositing is by physical vapor deposition.
- 1 30. The process of claim 28, wherein the metalorganic layer is selected from the group
2 consisting of iron phthalocyanine and molybdenum phthalocyanine or mixtures thereof
- 1 31. The process of claim 30, wherein the metalorganic layer is iron phthalocyanine.
- 2 32. The process of claim 28, wherein the substrate is selected from the group consisting of
3 silicon oxide, aluminum oxide, and magnesium oxide, or mixtures thereof.
- 1 33. The process of claim 28, wherein the deposition mask is selected from the group
2 consisting of silicon oxide and aluminum oxide.
- 1 34. The process of claim 33, wherein the deposition mask is removed before oxidizing.

1 35. The process of claim 33, wherein the deposition mask is removed after oxidizing.

1 36. The process of claim 28, wherein oxidizing comprises exposing to an oxygenating
2 atmosphere.

1 37. The process of claim 28, wherein the carbon precursor gas is selected from the group
2 consisting of methane, ethane, propane, ethylene, propene, and carbon dioxide.

1 38. The process of claim 28, wherein the carbon precursor gas is methane.

1 39. The process of claim 37, further comprising another gas.

1 40. The process of claim 39, wherein the other gas is selected from the group consisting of
2 hydrogen, helium, argon, neon, krypton and xenon or a mixture thereof.

Rule 26 1 41. The process of claim 38, further comprising hydrogen and argon.